[0021] FIG. 1 is a simplified diagram of an electronic system 100 with a converter bypass mode according to some embodiments. Electronic system 100 includes an electronic device 110. Electronic device 110 may be virtually any electronic device, such as a desktop or portable computer, a mobile computing device such as a smart phone or watch, a remote control, an electric and/or hybrid electric vehicle, and/or the like. Electronic device 110 may include one or more electronics modules 120 that serve as a load of the electronic system 100. Electronics module 120 may include any electronic component of the above mentioned electronic devices such as an integrated circuit, a display, an actuator, a sensor, a signal processor circuit, and/or the like and/or a combination thereof. In some examples, electronics module 120 may be coupled to a battery 125. Battery 125 serves as a load of electronic system 100 when charging and as a source of power when discharging. According to some examples, battery 125 may be charged when electronics module 120 is receiving power from an external power source and may be discharged when no external power source is available. Battery 125 may include any suitable energy storage device such as, without limitation, a lithium ion battery, a capacitor, a supercapacitor and/or the like.

[0022] Electronic device 110 receives power using a power supply 130. According to some embodiments, power supply 130 may include a rectifier 140 and a converter 150. Rectifier 140 performs alternating current (AC) to direct current (DC) conversion to convert received AC power into DC power. Rectifier 140 may use any suitable topology, or combination of topologies, such as full-bridge and/or half-bridge, and may be synchronous or asynchronous. Converter 150 performs DC-DC conversion to shift the voltage of the DC power for delivery to electronic module 120 and/or battery 125. Like rectifier 140, converter 150 may use any suitable topology, including synchronous or asynchronous topologies. For example, when converter 150 is a DC-DC switched mode converter, the topology of converter 150 may include buck, boost, buck-boost, flyback, forward, or any other suitable DC-DC switched mode topology.

[0023] According to some embodiments, converter 150 may have a bypass mode that allows the power conversion step to be bypassed. Consistent with such embodiments, converter 150 may be associated with a bypass switch 160. When bypass switch 160 is open, power from rectifier 140 is conditioned by converter 150 before being delivered to electronic module 120. When bypass switch 160 is closed, power from rectifier 140 is delivered directly to electronic module 120 without further conditioning by converter 150. The bypass mode of converter 150 reduces energy losses associated with converter 150 in situations where the power conversion step can be skipped, such as when the power from rectifier 140 is suitable for delivery to electronic module 120 without further conditioning by converter 150.

[0024] Power supply 130 receives power from an external power source 170. As depicted in FIG. 1, power supply 130 may be configured as a wireless power receiver. In accordance with such embodiments, external power source 170 is configured as a wireless power transmitter. According to some examples, electromagnetic fields may be used to transmit power from external power source 170 to power supply 130. In some embodiments, when the electromagnetic fields include time-varying magnetic fields, external power source 160 may be coupled to power supply 130 using inductive, near-field, and/or resonant power transfer

coupling mechanisms and/or the like. In furtherance of such embodiments, external power source 170 and power supply 130 may include inductive coils 180 for wireless power transfer. In addition to transporting electrical power, the electromagnetic fields may also be used to communicate data between electronic device 110 and external power source 170. Although FIG. 1 depicts wireless power transfer from external power source 170 to power supply 130, it is to be understood that power supply 130 may alternately, or additionally, be configured as a wired power supply. In furtherance of such embodiments, external power source 170 is configured to provide power over a wire. The wire may include any suitable conductor, such as a USB cable, an Ethernet cable, a dock connector, an AC power cord, a laptop charging cable, and/or the like. In addition to transporting electrical power, the cable may also be used to communicate data between electronic device 110 and external power source 170.

[0025] FIG. 2 is a simplified diagram of a buck converter 200 with a bypass mode according to some embodiments. In some embodiments consistent with FIG. 1, buck converter 200 may be used to implement at least some portions of power supply 130, including converter 150 and/or bypass switch 160.

[0026] Buck converter 200 performs DC-DC conversion between input node 212 (V_IN) and output node 214 (V_OUT). The DC voltage of output node 214 is configurable within a range from zero volts to the DC voltage of input node 212. Compared to other circuits that may be used to perform DC-DC conversion, the buck topology, as employed by buck converter 200, is efficient in terms of energy dissipation and size. As depicted in FIG. 2, buck converter 200 has a synchronous buck topology, which includes a high-side pulsed switch 222 coupled between input node 212 and switching node 216, a low-side pulsed switch 224 coupled between switch node 216 and ground, an inductor 226 coupled between switching node 216 and output node 214, and a capacitor 228 coupled between output node 214 and ground. In the synchronous buck topology depicted in FIG. 2, pulsed switches 222 and 224 are synchronously switched—that is, when one switch is closed the other is open and vice versa. The switching occurs at high frequencies (e.g., 10 kHz and higher).

[0027] In some examples, inductor 226 may include an air core inductor, ferrite core inductor, integrated circuit (IC) inductor, and/or the like. The inductance of inductor 224 is generally selected based on the switching frequency and the allowable ripple current of buck converter 200 and may therefore vary over a wide range based on the intended application. For example, the inductance of inductor 232 may be in the range from 1 µH to 100 mH. Similarly, capacitor 228 may include any suitable type of capacitor, such as an electrolytic capacitor, ceramic capacitor, polymer capacitor, and/or the like. In some embodiments, capacitor 228 may be omitted. For example, the capacitance of capacitor 228 may be in the range from 0 F to 1 mF.

[0028] Pulsed switches 222 and 224 are opened and closed (i.e., turned off and on) using a controller 232 and a driver 234. Controller 232 monitors the DC voltage of output node 214 and generates a pulsed width modulation (PWM) control signal to maintain the DC voltage of output node 214 at a desired level. According to some embodiments, the PWM control signal may include a series of voltage pulses transmitted at regular intervals and having a variable duty cycle.